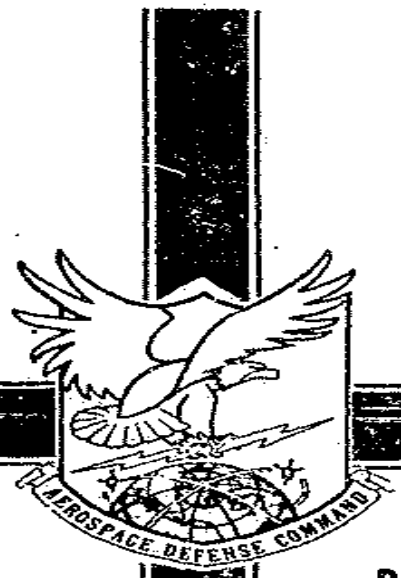

AEROSPACE DEFENSE COMMAND

REQUIRED OPERATIONAL CAPABILITY (ROC) FOR SIMPLIFIED PROCESSING STATION (SPS)

ADCOM 3-77

HEADQUARTERS
AEROSPACE DEFENSE COMMAND
PETERSON AIR FORCE BASE, COLORADO 80914
10 JUNE 1977

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AEROSPACE DEFENSE COMMAND
PETERSON AIR FORCE BASE, COLORADO 80914

REPLY TO ATTN OF: XPD (Maj Phillip J. Baker/692-3201) Dist Date: 10 Jun 77

SUBJECT: Required Operational Capability (ROC) ADCOM 3-77
Simplified Processing Station (SPS)

STATEMENT OF NEED

1. One of the missions of ADCOM, outlined in the FY78 Joint Strategic Capabilities Plan (JSCP) is to conduct worldwide surveillance of missile launches and nuclear bursts in order to provide timely warning and characterization of missile attacks and nuclear detonations. As stated in several documents, including the Worldwide Military Command and Control System (WWMCCS) Objectives Plan, this mission must be accomplished during the pre-, trans-, and post-attack periods of a nuclear war. In order to accomplish this mission there is an immediate requirement to:

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2. The Joint Strategic Objectives Plan (JSOP) for FY 79-86, Volume I, and the Defense Guidance of 9 Nov 76 define the regions which require warning and attack charcterization: North, Central and South America, Western Europe, Middle East, Africa, Southeast Asia and the Polar Regions. The specified regions require surveillance, warning and attack characterization worldwide - - - far beyond the coverage of existing and planned radar systems which are deployed to provide warning of a CONUS attack.

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6. Survivability is integral to the importance of the warning and attack characterization mission

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STATEMENT OF OPERATIONAL CAPABILITY

1. To allow for an increase in the survivability of DSP data, additional data processing facilities should be developed and deployed.

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2. The Ground Communication Network (GCN) should be upgraded to insure key command centers continue to receive data from the ground processing segment during periods of degraded communications.

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Users should have the capability to access non-associated communication nodes through non-dedicated communication links such as AUTOVON in the event their associated communication node is not available. Growth potential should include expansion to SURVSATCOM.

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Both of these functions require continuous status information on the ground stations, communication nodes and communication media at the NCOC and other users. The upgraded communication system should have an exercise capability to provide training, testing including simulation degradation and failure of communication nodes, and stress testing. In order to provide a standard protocol the communication system should be designed with or develop plans to transition to ADCCP protocol. All classified voice and data traffic, both primary and alternate, will be secured. Reference AFM 100-45.

3. Hardware maintenance concepts have been determined. This process will consist of isolation to a single faulty Line Replaceable Unit (LRU), replacement with a serviceable LRU and verification of correct operation. This process will be utilized at the data processing facilities and the upgraded GCN. All functions will be performed by military personnel since the system is a direct combat support function (Reference AFR 26-10).

W. C. Burrows, Maj Gen, USAF
DCS/Plans and Programs

3 Atch
1. Expanded Rationale
2. Preferred Solution
~~3. Distribution of Draft~~
~~RDC~~

EXPANDED RATIONALE

1. The Defense Support Program (DSP) System detects and reports missile launches and atmospheric and exoatmospheric nuclear detonation (NUDET) events.

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The missile warning and NUDETS data are required during the pre-, trans-, and post-attack periods.

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The GCN consists of a Data Distribution Center (DDC) b(1) and leased commercial communications means to the users. b(1)

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3. The DSP missile launch and NUDET data are required during pre-attack, trans-attack, and post-attack periods. The Joint Chiefs of Staff (JCS), Worldwide Military Command Control

System (WWMCCS), Department of Defense (DOD) and Air Force documents listed below define the requirement for ADCOM's worldwide warning and attack characterization mission and that this mission must be accomplished during the pre-, trans-, and post-attack periods of a nuclear war.

a. The FY78 Joint Strategic Capabilities Plan (JSCP) directs three missions for CINCAD which have a direct and mandatory requirement for DSP data:

(1) Conduct surveillance of missile launches and nuclear bursts to provide timely warning and characterization of missile attacks and nuclear detonations worldwide.

(2) Insure that projected ADCOM systems that contribute warning and assessment capabilities are responsive to the needs of the NCA/Joint Chiefs of Staff through the WWMCCS.

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b. The Joint Strategic Objectives Plan (JSOP) for FY 79-86 provides objectives for missile attack warning and assessment and defines regions worldwide where flexibility and responsiveness are needed to support national interests.

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c. The Defense Guidance, 9 Nov 76, Section: Policy Guidance, Para IIIB Regional Analysis discusses the areas of

security interest and attempts to prioritize them as follows: "While security priorities can change as a result of changes in the international situation, our first priority is the security of the United States and our security interests in North America and the Western Hemisphere.

d. The DSP Program Management Directive (PMD), dated 21 Jun 76, states as an objective: "To provide a highly available, survivable, and reliable satellite-borne surveillance system which will detect and report in near real time during pre-attack and trans-attack periods.

e. USAF ROC 13-73, Ballistic Missile Attack Warning and Assessment states that "During trans-attack periods, the ability to discern follow-on launches and to furnish NUDET information is recognized as an objective."

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g. WWMCCS critical mid-range objective, CM-400 states: "Missile Warning. Improve availability and reliability of missle warning systems data for information support of the NCA and appropriate command centers.

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h. The WWMCCS Objectives Plan for FY 1975-1994 b(1) This document is supported by the AUCOM Command and Control System Master Plan.

i. WWMCCS mid-range objective, M-402, calls for enhancement of DSP ground station b(1)

j. b(1) WWMCCS long range objective, L-402 calls for a data during pre-, trans- and post-attack periods.

k. SAC document, "The Role of the Defense Support Program in Strategic Force Management," dated 10 Nov 75 presents concepts for application of DSP data

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4. As stated in paragraph 1, the current users of high speed DSP data are

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5. The threat to DSP comes from several sources.

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The Defense Intelligence Projections for Planning (DIPP), Section IIIE, dated Jun 76, states that "As the U.S. places increasing numbers of high-value targets in geo-stationary altitude orbits and beyond, the Soviets will no doubt develop the intercept capability for those altitudes. Such a capability could be accomplished by approximately 1978 with little modification to the current Soviet satellite interceptor."

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6. As discussed above, the DSP satellite currently has a degree of survivability and several improvements have been made or are planned.

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b(1)

7. In order to achieve a more viable and survivable system, the survivability of the DSP ground system must be increased.

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8. In arriving at the required number of DSP ground stations, the survivability of DSP data must be examined considering the user's need for that data.

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b(1)

The only difference is that three of the command centers have some degree of hardness and the National Emergency Airborne Command Post (NEACP) and the SAC Airborne Command Post (ABNCP) have a degree of survivability due to mobility.

[redacted]

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[redacted]

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11. The improved GCN should provide communication survivability commensurate with the new data processing facilities.

a. Each data processing facility should have a communication node and be capable of utilizing various communications media to tie together the data processing facilities and the command centers. The communication node should be collocated with the data processing facility, primarily for reduced operation and maintenance costs. This collocation is also useful for EMP protection by being outside the command center collateral damage region.

b(1)

b. Leased commercial lines will tie the communications nodes together with enough links to assure common data is provided to each user during non-wartime situations. Since the ground communications vulnerability to EMP is unknown, satellite communication should be provided between the nodes. The satellite communication terminals should be EMP hardened and provide an additional degree of survivability over and above the ground system. If the ground and space nodes of communications are impaired, the personnel in the data processing facilities should have a contingency plan to re-establish communication with other nodes. A cost effective method would be to provide a general

purpose AUTOVON at each node. In addition, a dedicated secure voice circuit with conferencing capability is required so that the Missile Warning Center in the NCOC can conference all processing stations.

c. The communication node at the b(1) and either this communication node can service all low speed users or low speed users can be serviced by the nearest communication node. Summary messages, discussed in the next sub-paragraph, should be considered a candidate for low speed users after a threshold number of launches has been reached. The DDC should be replaced because there is no longer a growth capability to add low speed users within the present DDC system and the computers are no longer built; therefore, it is increasingly difficult to obtain replacement parts. The crypto devices in the ground stations and users should be standardized including airborne users.

d. Probably the most survivable command posts are the b(1) These command posts should be provided DSR data when the primary ground command centers are incapacitated. There are, however, two limiting features with these command posts: They currently have only a 75 baud communication capability which is slow for sending individual reports; and they do not have, nor are there plans to provide, computer capabilities on board any of the b(1) In order to overcome these limitations, the communication nodes must have the capability to generate summary messages during attacks and transmit them to the b(1) Enough threat processing must be done for Mission A events to determine whether the missile detections are threats or non-threats. The nodes must also retain the capability to send individual or amplifying reports to airborne users for small attacks or for the accomplishment of post-attack missions such as damage evaluation. Each data processing facility should have the capability to send data to airborne users either via direct UHF or through a Ground Entry Point (GEP).

e. With the number of ground stations, communications nodes and communications media, a central systems control function is required. This systems control will include assignment of ground stations to satellites, assignment of users to communications nodes, and assignment of communication media. This central controlling function should be located in the NORAD Combat Operations Center (NCOC). During non-wartime operations switching ground stations/satellites, communication nodes and

media will be controlled by the NCOC and will be accomplished by instruction over the Teletype Users Data Entry (TUDE). During a wartime situation, NCOC will accomplish this function as long as possible. Other users should be capable of switching from their associated communication node to a non-associated node. This switching should be as rapid as possible. The user should also be capable of accessing the memory of the communication node and calling all data transmitted since a reference time provided by the user. In order to accomplish these functions the NCOC and other users must have status data from the ground stations, communications nodes and communications media.

f. A capability to exercise the entire communication system is required. This system exercise should include the capability to input scenarios from small numbers of launches up to maximum throughput of the system. This capability is needed to train operator and command center personnel, to monitor system performance and to checkout system modifications. The exercise capability should include simulating degradation and failure of ground stations and communications, exercise of system control by the NCOC, exercise of communication node switching by the users, and stress testing of the system.

g. The PAVE PAWS system is going to use ADCCP protocol. This protocol appears to be more efficient and flexible than the current DSP/ASCII protocol. The new communication system should use the ADCCP protocol. This will give the added advantage of standardizing protocol for all warning systems.

12. Command and Status (C&S) processing for the DSP (after satellite turnover from the SPO) is performed at the CGS and the OGS. Satellite command authority for a given hemisphere rests with the respective site commander.

a. C&S is supported by a group of Satellite System Engineers (SSE) who provide expertise in determination of satellite status and command requirements. C&S at the Large Processing Stations (LPS) includes:

(1) State-of-Health.

(2) Trending for determination and correction of anomalous conditions.

(3) Attitude maintenance, including star catalogs, boresight maintenance, and momentum estimation.

(4) Time-ordered parameters processing, including ephemeris processing and ranging.

(5) Command generation, including command formatting, determination of command constraints and functional verification.

(6) Sensor management, including threshold adjustments, cell control, sensor calibrations, and sensor reconfiguration.

(7) b(1)

b. All of the above functions must be performed in order to support sustained operation of any given satellite, and becomes increasingly complex as satellite configurations diverge due to anomalous conditions, mission enhancements, or hardware modifications. Since C&S processing for each hemisphere is performed at a single ground station.

b(1)

c. An emergency backup C&S capability presently exists with the Air Force Satellite Control Facility (AFSCF)

b(1)

d. The frequency of C&S support varies from once per quarter hour up to once per month, and is primarily a factor of a given satellite's health and well-being. A healthy satellite could support mission requirements through a trans-attack period with little or no ground C&S support. As health decreases, the requirement for analytical support and subjective judgments increase. This complexity is difficult, if not impossible, to automate to the point where a single site Senior Director (SD) could perform all satellite C&S functions alone.

e. Any disaster or hostile action of a magnitude that would cause a long term LPS outage could also result in the loss of some or all SSE personnel. Therefore, additional SSE manning would be required to support a full capability backup station.

f. C&S support for additionally deployed satellites should be performed at a single station in a given hemisphere. Command authority must be centralized so that only the primary or backup station would be capable of commanding a given satellite. One additional C&S capability would be required for each new satellite deployed over the present b(1) Data processing for C&S would then be performed in only the primary or the backup facility regardless of the number of satellites in that hemisphere. The C&S function should be capable of independent processing, i.e., each data processing facility with C&S should be able to process two missions A and B, Link 4 and C&S simultaneously.

g. b(1) Ranging on a given satellite requires ranging capability at b(1) ground stations. The two ground stations with a command and status capability should also have a ranging capability.

h. Each new data processing facility that includes C&S capability requires a spacecraft simulator for testing and training.

i. For the DSP NUDETS Sensor systems the SSE function is provided by technical analysts at b(1) who continuously monitor raw sensor data and provide technical guidance as needed. The new data processing facility should have the capability to provide DSP NUDET sensor data to b(1)

j. In summary, a command and control capability should be procured for a minimum of two data processing facilities to provide command and control survivability for both the Eastern (single string C&S) and Western (dual string C&S) Hemisphere. SSE personnel should be provided at each of these data processing facilities.

13. Support and Training

a. The new data processing facilities will require support from a central host computer facility for software

maintenance, configuration management and control, training, analytical and intelligence support, and generation of time dependent data, such as ephemeris. This support is provided to the present LPSs by the Multi-Purpose Facility (MPF). The MPF can also support the new data processing facilities if provided with adequate additional manning and a data processing unit similar to the new stations. No antenna would be required. Additional resources would be required to support software maintenance for the communications nodes. An alternative to this approach would be to have a compatible host computer near one of the data processing units to act as host computer for some or all of these functions.

b. Software maintenance could be performed at one of the new sites with support at the MPF. Software development would have to be done at the MPF with final testing performed at the operating site. This could cause considerable TDY expenditures and some delays. Again a suitable host computer near an SPS could be used to accomplish this function.

c. Training of the ADCOM personnel will be provided by ATC. The hands-on training will be provided at one of the data processing facilities located in CONUS. This data processing facility will be chosen based on cost of travel and operational considerations. The training will be on a scheduled basis and will not be accomplished

b(1)

d. The prototype data processing facility will initially be used for software maintenance and training. Programmer personnel stationed at this data processing facility will provide support to the other data processing facilities and MPF as required. An exercise and evaluation capability such as wideband tape input, will be provided with this facility as a training, software maintenance and evaluation tool.

PREFERRED SOLUTION AND ALTERNATIVES

1. Two alternative solutions that were examined were the b(1) These solutions would provide the increased processing capability and increase the survivability of the DSP data, however, they had the following disadvantages:

a.

(1) b(1)

(2) Higher cost of facilities and equipment compared to the preferred solution.

(3) Greater manpower requirements compared to the preferred solution.

b.

(1) b(1)

(2) Much higher development costs and higher risk due to technology than the preferred solution.

(3) Higher operations and maintenance costs than the preferred solution.

(4) Development schedule would be longer.

2. Because of the above disadvantages, processing deficiencies, and the vulnerability of the DSP ground system described in Attachment 1, the following operational capability is the optimum preferred solution:

b(1)

requirement arises. Relocation may be required for several reasons, including base closures, host country problems, changes in operational concepts and coverage requirements/ satellite deployment.

b(1)

b. An upgraded ground communication network that eliminates the single mission data communication node at the b(1) is required. This network should have several nodes, b(1) Each node should be connected to its associated user(s) by an EMP hardened line. The network should be configured so that duplicate reports on a missile launch are eliminated at the source under normal conditions, with the capability also at the users, if needed. As a minimum, the upgraded GCN should have terrestrial communication similar to the current system with interconnectivity to insure common data to the users; Defense Satellite Communication System (DSCS) as a more survivable system; AUTOVON dial-up as a backup; and direct and Ground Entry Point (GEP) access for UHF to an ABNCPs. The system should also have growth potential to SURVSATCOM. The purpose of the communication node is

b(1)

The new communication node at the CGS should be expanded to provide data to all low speed users or the low speed users should obtain data from its nearest communication node. The system should have a central system control function in the NCOC. The users should have the capability to access non-associated communications nodes and media as rapidly as possible and re-call all data transmitted

TABLE 1: OPTIMUM SOLUTION

SPS	LOCATION	CAPABILITIES	FUNCTIONS
1	b(1)	Dual*, C&S (Dual String), AFTAC Mission B, Link 4	Survivability of Western Hemisphere data, Full CGS backup, Software Maintenance, Training, associated with NEACP
2		Dual, C&S (Single String), AFTAC Mission B, Link 4	Survivability of Eastern Hemisphere data, Full OGS backup, associated with b(1)
3		Dual	Survivability of Eastern Hemisphere data, associated b(1)
4		Dual	Survivability of Western Hemisphere data, associated b(1)
5		Dual	Survivability of Western Hemisphere data, associated b(1)

* Dual is defined as simultaneous processing of both Mission A and B from two satellites.

since a reference time provided by the user. An exercise capability should be provided within the system. ADCCP protocol should replace the current DSP/ASCII protocol. The KG-13 crypto devices must be replaced with updated and improved units to make the system compatible with the new communication nodes. The NCOC Missile Warning Officer must have dedicated circuits to all processing stations with secure voice conferencing capability.

b(1)

3. The minimum-essential solution to increase the survivability of

b(1)

The locations, capabilities and functions of each of the four SPSs are summarized in Table 2. This minimum solution provides approximately the same survivability of Eastern Hemisphere data as the optimum solution, however, the survivability of Western Hemisphere data is decreased from the optimum solution because of one less SPS in the Western Hemisphere and the Eastern Hemisphere SPSs are only single satellite versions. In addition, this solution does not allow growth potential to an increased satellite deployment and maintenance of the same survivability. Because of these shortcomings, the optimum solution is recommended. The same basic upgraded GCN should be provided with the minimum solution. The only difference is that there will be one less communication node.

4. Operational Concept and Influencing Factors.

a. The following information summarizes the SPS Operations Employment Concept (OEC) forwarded to JCS by AF/XOX in November 1975 and is considered as the baseline. The only changes this ROC envisions to the OEC is that the SPS will have the capability to communicate through DSCS, two SPSs will have a full Command and Status capability; and each b(1) sensor data to b(1) The OEC is based on the optimum solution in Table I. The plan for Utilization of the Prototype is dated 23 Jan 76.

TABLE 2: MINIMUM - ESSENTIAL SOLUTION

SPS	LOCATION	CAPABILITIES	FUNCTIONS
1	b(1)	Dual, C&S (Dual String), AFTAC Mission B, Link 4	
2		Single*, C&S (Single String), AFTAC Mission B, Link 4	b(1)
3		Single	
4		Dual	

* Single is defined as simultaneous processing of Mission A and B from one satellite.

b(1)

(4) Locate near military support facilities especially when an SPS will be at a location indefinitely.

d. b(1) SPSs are considered the optimum number to provide adequate processing capability and survivability for Western and Eastern Hemisphere satellite data for the four major command centers plus PACOM and EUCOM.

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b(1)

e. The first SPS is being developed as a prototype. After the prototype Initial Operational Test and Evaluation (IOT&E) has been successfully completed, it will become operational with ADCOM crews performing operations and maintenance with contractor support.

b(1)

and with a capability to provide DSP NUDET sensor data to b(1) This SPS should have

b(1)

The high speed data will initially go to the DDC with a by-pass capability to NCOC. It will be

connected to the upgraded GCN when available.

b(1)

(3) Few primary targets within the region.

(4) Support facilities are available on this base.

5. Reliability and Maintainability.

a. Reliability/Maintainability Program Plan will establish the plans, organization, and controls for an effective reliability and maintainability program to economically achieve the requirements of the SPS and GCN. The plan will be constructed in accordance with the MIL-STD-470 and MIL-STD-785A and will be to influence system design of the SPS, comprised of GFE, off-the-shelf, and newly designed hardware and software to yield optimum reliability, maintenance features requiring minimum maintenance skill levels, low manning levels, and low life-cycle cost.

b. A Diagnostic Computer Program (DCP) shall be designed to require no maintainer intervention except to control the extent of the exercise, verify the performance of operator interface equipment, or perform configuration switching. When the DCP cannot accomplish fault isolation, the DCP shall identify the subsystem and component tests failed and direct the maintainer to an appropriate Fault Localization and Isolation Procedure.

6. Maintenance Concept.

The specified maintenance concept of the SPS and GCN shall consist of isolation to a single faulty Line Replaceable Unit (LRU), replacement with a serviceable LRU and verification of correct operation. The faulty LRU will be discarded or depot repaired. Ninety percent of the faulty LRUs will be isolated by the DCP with the remainder isolated through a combination of the DCP, Built-In Test Equipment (BITE), and manual

procedures. All maintenance functions will be performed by Air Force personnel.

7. Integrated Logistic Support Program.

An Integrated Logistics Support Plan for the SPS has been developed, in accordance with AFR-800-8, and distributed. This document contains appropriate data on Reliability and Maintainability, Maintenance Concept, Transportation and Handling and Communications Security. The document was prepared by SAMSO/SZT and dated 6 Jan 76.

8. Transportation/Packaging/Deployment.

a. Transportation will be in accordance with applicable policies and AFR 75, 76, and 77 series documents. Transportation plans will be required to support pre-production phase movement. Detailed transporation plans will be acquired and updated in the production phase as necessary to assure efficient delivery of first production items and preparation for operational phase transportation needs. Transportability engineering will be in accordance with AFR 80-18 and MIL-P-9024. The transportability requirement for the SPS emphasizes the need for logistics planning to insure the capability to transport, preserve, package and handle all equipment and support items. Transportation and packaging personnel, working closely with the design engineers, will assist in shelter and equipment designs to meet transportability requirements, identify problems or constraints as development progresses, react to eliminate/reduce their impact, and provide resolution of unavoidable constraints.

b. Preservation, packaging and packing will be in accordance with the policies established by AFR 71 series directives. The principle of minimum tare, cube and cost consistent with required protection will be adhered to at all times. Packaging requirements developed/stipulated will be standardized to the maximum extent compatible with this criteria (reference (MIL-STD-1510).

9. Survivability

The survivability program for the SPS and GCN will be in accordance with the policy established in AFR 80-38. The survivability philosophy of the SPS concept is to provide each

station with

b(1)

10. Safety

No explosive, missiles or aircraft will be part of the SPS system. System safety will be designed into the hardware by AFSC in accordance with AFR 12-8. Safety will be inherent within the procedures for disassembly, transportation, assembly and checkout of the SPS.

11. Communications Security

All classified voice and data traffic, both primary and backup, will be secured in a cordance with AFM 100-45. The secure voice should use HY-11/KG-34 equipment. High and low speed data should be secured using TSEC/KG-34 type equipment.

12. Environmental Impact.

No significant detrimental impacts on the environment are expected from deployment and operation of the SPS. ADCOM will prepare an environmental assessment for the operational prototype location and production locations which will address the specific environmental effects at these locations.

13. Automatic Data Processing Equipment (ADPE)

ADPE will be required to process satellite data. The primary data processing requirements are to preprocess Link 1 and 2 data, calculate missile warning and nuclear detonation data, prepare messages, and calculate satellite command parameters. No new ADPE will be developed specifically for the SPS. All ADPE will be acquired and operated following the policies of AFR 300-2 and AFR 800-14. In accordance with AFR 300-8, computer security techniques and procedures will be implemented to adequately protect the vulnerabilities of ADPE from exploitation. Computer software will be developed for the prototype SPS and will be used for all other SPSs.

14. Physical Security Requirements

b(1) The security standard for the SPS, developed by ADCOM will be included as a new chapter to AFM 207-21, by HQ USAP/SP.

15. Manpower

The primary functions at each SPS and communication node that take manpower are operations, maintenance and security. In general, an SPS will accomplish these functions with approximately 40-50 personnel, because of the high degree of automation and the fact that the SPS will be located on a base with AFR 11-4 support. This figure also assumes the SPS and communication node are collocated and have the same types equipment and maintenance concepts. Those SPSs with a C&S capability will require approximately 10-15 additional personnel to accomplish that function. The Multi-Purpose Facility (MPF) and the SPS that provides software support and training will require some additional personnel to do ephemeris generation, software maintenance and training.

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